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SIDS risk reduction and infant sleep location – moving the discussion forward.

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Abstract

The notion that infant sleep environments are 'good' or 'bad' and that parents who receive appropriate instruction will modify their infant-care habits has been fundamental to SIDS reduction campaigns. However infant sleep location recommendations have failed to emulate the previously successful infant sleep position campaigns that dramatically reduced infant deaths. In this paper we discuss the conflict between 'safeguarding' and 'well-being', contradictory messages, and rejected advice regarding infant sleep location. Following a summary of the relevant background literature we argue that bed-sharing is not a modifiable infant-care practice that can be influenced by risk-education and simple recommendations. We propose that differentiation between infant-care practices, parental behaviors, and cultural beliefs would assist in the development of risk-reduction interventions. Failure to recognize the importance of infant sleep location to ethnic and sub-cultural identity, has led to inappropriate and ineffective risk-reduction messages that are rejected by their target populations. Furthermore transfer of recommendations from one geographic or cultural setting to another without evaluation of variation within and between the origin and destination populations has led to inappropriate targeting of groups or behaviors. We present examples of how more detailed research and culturally-embedded interventions could reorient discussion around infant sleep location.

Introduction

For social scientists the question of where and with whom babies sleep does not have a right or wrong answer, but involves biology, history, cultural values, context and motivation to determine outcomes. Public health specialists, however, designate infant sleep locations as appropriate (e.g. infant-specific furniture such as cribs) or inappropriate (all other surfaces including non-infant-specific furniture and adult bodies). Our purpose in this paper is to explore why recommendations addressing infant sleep location and risks of infant death have failed to emulate previous successful public information campaigns regarding infant sleep position, and propose that consideration of two particular issues could improve policy and practice in this arena:

- a) Recognition of the importance of infant sleep location to ethnic and sub-cultural identities, to reframe ineffective risk reduction messages that are rejected or ignored, and to generate culturally-embedded interventions that support cultural values; and
- b) Comparison between research populations from whom risk reduction messages are generated and intervention populations to whom they are applied to avoid inappropriate message-transfer about infant sleep location from one setting to another.

Following a summary of the relevant background we review the evidence and implications relating to these issues, and present examples of how cultural considerations can be more effectively incorporated into infant sleep location research and interventions.

Infant sleep-related mortality – the quest for understanding risk factors

Sudden Infant Death Syndrome (SIDS)

Since the creation in 1965 of code 795 under the International Classification of Diseases (ICD-8) for infant deaths termed Sudden Infant Death Syndrome, researchers have been searching for factors that explain sudden unexpected deaths of infants with no apparent cause. SIDS is a category of exclusion for designating the death of an infant where a post-mortem examination (and often a death scene investigation) fails to determine a specific cause (Willinger et al. 1991). Initial efforts to understand which infants were at greatest risk of SIDS focused upon socio-economic and intrinsic infant variables; SIDS was prevalent in circumstances of deprivation (Mitchell et al. 2000), amongst low birth-weight, and premature infants (McCormick 1985). With no underlying 'cause' to tackle, strategies for SIDS prevention were based upon characteristics of infants who died--but without corresponding information on the characteristics of infants who survived it was difficult to ascertain which factors to target (e.g. Taylor and Emery 1988).

Research into SIDS characteristics was prioritized in New Zealand where rates were especially high, with a national SIDS case-control study that became particularly influential (Mitchell et al. 1992; Mitchell 2009). Three factors accounted for 79% of SIDS deaths: prone infant sleeping position, maternal smoking, and not breastfeeding, triggering the launch in 1991 of the New Zealand Cot Death Prevention Programme (Mitchell 2009). Parents were encouraged to place their infants for sleep in a non-prone position, keep them smoke-free, and to breastfeed. Following further data analyses, avoidance of parent-infant bed-sharing was added in 1992 (Mitchell et al 1992; Mitchell 2009). Other countries with substantial

SIDS-rates such as the UK, Norway and Ireland (e.g. Fleming et al. 1996; Oyen et al. 1997; McGarvey et al. 2003) also conducted national case-control studies. All confirmed the association between prone infant sleep position and SIDS, leading to wide-scale 'Back to Sleep' campaigns, and dramatic reductions in infant deaths (e.g. Golding et al. 1992; De Jonge et al. 1993; Irgens et al. 1995; Markestad et al. 1995, Gilbert et al 2005).

Encouraging parents to sleep their infants in a supine position was associated with a fall in the US SIDS-rate from 1.2 to 0.53 per 1000 live births between 1992 and 2000 (Rasinski et al. 2003). Repeated saturation of infant-care guidelines with the Back to Sleep message resulted in a very low national prevalence of prone infant sleep wherever implemented, although the national figures mask some cultural/ethnic differences in uptake of the Back to Sleep message, particularly in the US (Colson et al. 2005; Hackett 2007; Von Kohorn et al. 2010). Subsequent studies identified further key risks: parental smoking, in particular maternal smoking during pregnancy and following birth, was a strong predictor of SIDS-risk in multiple studies. Sleep position, head-covering, overwrapping, and infant illness also were associated with increased risk (Fleming et al. 2003; Fleming et al. 1996) along with soft bedding, soft sleep surfaces, overheating (Flick et al. 2001; Moon, et al 2007), breastfeeding for less than two weeks, and 'co-sleeping' (Vennemann et al. 2009). For reasons that remain unclear, the risk of SIDS is particularly high for infants who sleep with parents on a sofa (Blair et al. 1999). Pacifier use during sleep is apparently protective (Moon et al. 2007; Vennemann et al. 2009) although there is some debate as to whether this might be a marker for something else such as change in family routine. Infants who sleep in a separate

room from their parents are at increased risk compared to infants who sleep in the same bedroom (Blair et al. 1999).

In the US, African American, Alaskan Native, and Native American communities are disproportionately affected by SIDS (NICHD 2001), and recently a higher incidence of SIDS in child-care settings has been identified (Moon, et al. 2008). In New Zealand, SIDS-risk is substantially higher in Maori families (Mitchell et al. 1993), but not those of Pacific Island origin (Scragg et al. 1995; Schluter et al. 2007). UK immigrants from 'New Commonwealth' countries (India, Pakistan, Bangladesh, and Caribbean) have a greatly reduced risk of SIDS compared with the White British population (Balarajan et al. 1989; Davies and Gantley 1994; ONS 2000), while in Holland infants of Moroccan immigrants have a SIDS-risk three-times lower than the Dutch population but infants of Turkish immigrants exhibit a significantly increased SIDS-risk (van Sleuwen et al. 2003).

Other sleep-related infant deaths

SIDS refers to sudden *unexplainable* infant deaths, and is grouped with other sudden *explainable* infant mortality under the heading Sudden Unexpected Death in Infancy (SUDI). The clinical characteristics of SIDS and explained SUDI are similar: infants in both groups have generally poorer health, a higher frequency of symptoms, and a history of apparent life-threatening events (ALTE) (Ward-Platt et al. 2000), however, maternal smoking during pregnancy is particularly relevant to the etiology of SIDS. Sleep environments are also implicated in infant suffocation deaths, and various lethal sleep environments have been described in detail (Byard et al. 1994; 2001). Regardless of the sleep locations, lack of

supervision was a factor in each of the cases examined. The differentiation of SIDS and explained SUDI is particularly problematic due to ambiguity in the pathological separation of SIDS and soft suffocation. In the case of bed-sharing deaths the evidence used is often circumstantial, and when infants die while bed-sharing coroners sometimes assign the death to the 'Unexplained/Unascertained' category rather than SIDS or SUDI due to the presence of a sleep-partner (O'Hara et al. 2000). This skews national figures and comparisons within populations, especially where bed-sharing is more prevalent in some sub-groups than others.

Considering parent-infant bed-sharing

The bed-sharing discussion began in earnest when anthropologists proposed that SIDS was a phenomenon of solitary infant sleep (Konner and Super 1987) and that infants benefitted from the sensory stimulation of sleeping in close proximity to their parents (termed co-sleeping). It was hypothesized this would help certain infants resist the arousal deficits thought to contribute to SIDS (McKenna 1986). McKenna combined evidence from infant physiology, human evolution, ethnographic reports, polysomnographic studies (McKenna 1990a,b; McKenna and Mosko 1990), and pursued sleep laboratory research to examine the effects of co-sleeping (for review see McKenna et al. 2007). McKenna's work generated tremendous popular and clinical interest, prompting epidemiologists to more closely examine infant sleep location in SIDS case-control studies. These produced an array of conflicting evidence, often due to variations in how sleep environments were categorized, variations in how parents were asked about their infant's sleep environment, and

interaction effects between sleep location and other variables (Ball et al. 1999; Horsley et al. 2007).

No SIDS case-control studies to date have supported McKenna's original hypothesis that parent-infant sleep contact reduces the risk to infants of SIDS, however it has been well documented that infants who sleep in their parents' room are at lower risk than those who sleep in a room alone (Mitchell and Thompson 1995; Blair et al. 1999; Carpenter et al. 2004). Although the New Zealand case-control study reported that parent-infant bed-sharing increased the risk of SIDS (Mitchell et al. 1992) further analysis revealed a key interaction between bed-sharing, SIDS and parental smoking (Mitchell and Scragg 1993; Scragg and Mitchell 1998). UK researchers confirmed that bed-sharing in combination with smoking was associated with an increased risk of SIDS but found no increase for infants of parents who did not smoke (Blair et al. 1999). The Chicago Infant Mortality Study found no interaction between maternal smoking and the risk of SIDS when bed-sharing (Hauck et al. 2003), however in the Netherlands bed-sharing was associated with an increased risk for infants under 2 months of age (Ruys et al. 2007).

Although Gessner and Porter (2006) estimated the maximum potential SIDS-risk for bed-sharing infants of non-smoking mothers as $<1/10000$, US authorities have more strongly recommended against bed-sharing over time, and it is now well-documented that some infant bed-sharing deaths are not SIDS but are preventable accidents. The Consumer Product Safety Commission (Drago and Dannenberg 1999; Nakamura et al. 1999) and the American Academy of Pediatrics (2005) have both advised against infants bed-sharing.

Based upon case-series data of infant deaths, statewide US infant fatality review boards and municipalities have mounted campaigns to convince parents that babies will die if they bed-share (Kendall-Tackett et al. 2010; Gettler and McKenna 2010).

Even though researchers have cautioned against imposing particular cultural values upon diverse ethnic groups (Pelayo et al. 2006; Lahr et al. 2007; Schluter et al. 2007) and generalizing SIDS-risks from one country to another (McGarvey et al. 2003), American Academy of Pediatrics guidelines have been recommended around the world, in countries with very different socio-demographic and ethnic compositions, cultural practices, and SIDS profiles than the United States (e.g. Alm et al. 2006; Huang and Cheng 2006; Mitchell 2007; Lope et al. 2010). The issue of importing SIDS-reduction recommendations from one population to another will be returned to below. Firstly however, we consider the cultural importance of infant sleep location and its role in the bed-sharing debate.

Conflicting infant health agendas

In Euro-American populations, bed-sharing is a parenting behavior valued by its proponents for reinforcing attachment, supporting infant development and facilitating breastfeeding, but viewed by its detractors as neglectful parenting exposing infants to risk of accidental death or SIDS. The dilemmas for parents, policy-makers and health professionals in weighing the risks (costs) and benefits associated with bed-sharing have been discussed for 20 years in the clinical and health practitioner literature. Emerging from studies of risk-factors is a complex picture in which bed-sharing is associated with both positive and negative infant

outcomes depending on the context of the sleep environment and the characteristics of parents and babies, making the provision of simple public health messages difficult.

The question of infant sleep location is caught between two public health agendas: Safeguarding (the prevention of infant death/injury and safety awareness); and Well-being (the promotion of breastfeeding, bonding and infant mental development). Both seek positive outcomes for infants—but these outcomes clearly differ. Success for Safeguarding involves reduced rates of fatalities and injuries; for Wellbeing it involves improved breastfeeding rates, reduced infant morbidity, appropriate growth and development, and secure attachment relationships. These agendas intersect, however their recommendations can seem contradictory, and interventions addressing one agenda may have a detrimental impact on the other.

Infant-care practices, parental behaviors, and cultural beliefs

The contrasts between the implementation of effective intervention campaigns to reduce prone infant sleep--and the controversy surrounding recommendations to avoid bed-sharing--highlight how certain aspects of infant sleep are imbued with cultural and personal values. Often overlooked are deeply-rooted beliefs attached to infant sleep location that speak to how the 'nature of infancy' and the 'purpose of parenting' are understood in different cultures and communities (e.g. Abbott 1992; Gantley et al. 1993; Crawford 1994; Eades et al. 1999; Abel et al. 2001) which is a primary reason why efforts to 'ban bed-sharing' are contentious.

One problem in SIDS-risk reduction, then, has been failure to differentiate between a) infant-care practices, b) parenting and parental behaviors, and c) cultural beliefs regarding infant sleep. Practices, behaviors and beliefs involve three 'levels of parental engagement' with SIDS-risks that require different approaches for effective intervention:

a) Infant-care practices are relatively simple actions performed by parents, involving little engagement or cultural value. As a simple practice infant sleep position was easily modifiable, and as widespread prone infant sleep resulted from medical recommendations emanating from the care of pre-term infants in the mid-twentieth century, it was not a culturally embedded phenomenon (Gilbert et al. 2005). Although supine infant sleep recommendations are challenged in some quarters (Hackett 2007; Moon et al. 2010) overall implementation met little parental resistance. In Norway preference for prone sleep fell from 64% to 8% in a few months following a supine-sleep campaign (Markestad et al. 1995); in Otago, New Zealand prone sleep of one month old babies fell from 42% in 1986 to 2% in 1989 (Taylor 1991). Similar SIDS-risk related infant-care practices involve removal of cot bumpers, and the positioning of infants' feet to the foot of the crib as recommended in UK.

b) Parental behaviors are activities parents choose to engage in (with direct or indirect impact on their infant). Breastfeeding is an example with direct impact; prenatal cigarette smoking by mothers is also direct, while maternal postnatal smoking and paternal smoking are indirect. Parents alter such behaviors when the benefits of doing so outweigh the costs, e.g. Tully and Ball (2011). Bed-sharing affects the degree of night-time parental-infant interaction and often is a behavior that parents actively choose. Parental behaviors will be more difficult to alter than infant-care practices, as this involves both a change in attitude

about the behavior, and personal commitment to behavior change for the parent: it cannot simply be achieved by the provision of information (Mehanni et al. 1999).

c) Cultural beliefs regarding infant sleep involve embedded shared notions of the nature of infancy, role of the parent, and the wider cultural milieu in which infants are 'raised' or 'nurtured' (e.g. Abbott 1992; Gantley et al. 1993; Crawford 1994; Eades et al. 1999; Abel et al. 2001). Meanings attached to infant sleep location reflect cultural paradigms regarding infancy such as fostering dependence or independence, nurturing one's infant or training them for adulthood (e.g. Welles-Nystrom 2005; Valentin 2005). Attempts to change parenting beliefs challenge the cultural identity of the target parents, and their community. When interventions challenge valued cultural beliefs risk reduction messages are dismissed as culturally irrelevant (Hackett 2007; Schluter et al. 2007; Blabey and Gessner 2009).

The phrase 'Modifiable Risk Factors' is often used in SIDS literature to identify aspects of infant-care assumed to be malleable. However, they comprise a heterogeneous collection of infant-care practices, parental behaviors, and cultural beliefs. It is ineffective to employ the same approaches to these different types of 'risk factors'. Modifying infant sleep position via 'Back to Sleep' campaigns involved a simple and easily implemented change in practice. In tackling intractable parental behaviors such as smoking, SIDS messages have been modified to accommodate smokers' inability or unwillingness to quit (e.g. Mehanni et al. 1999) and more moderate behavior changes such as 'Cutting Down' in pregnancy and 'Keep the Baby Smoke-Free' are encouraged. Here both the message and the target behavior have been modified to reduce some risk.

As bed-sharing is not a simple infant-care practice it is not easily modifiable by information campaigns. Thus recent US intervention programs that emphasize a 'Don't Sleep With Your Baby' slogan are both naïve and inappropriate. Failure to acknowledge the cultural and personal importance attached to bed-sharing by large sub-groups of the US population is also evident in infant crib donation programs (e.g. Bedtime Basics) that attract large philanthropic donations. Outside the US more nuanced approaches are emerging to provide individualized or culturally tailored guidance and interventions where infants may be at risk as a consequence of their sleep location. As with the compromises made around smoking and SIDS-reduction, these interventions help parents maximize their infants' safety within the parameters of their own willingness or ability to alter behaviors or beliefs.

The appropriateness of categorizing SIDS risk factors into 'modifiable' and 'unmodifiable' has also recently been challenged by McManus et al (2010) on the grounds that a) what is easily modifiable in middle-class sectors of society is not modifiable for those who are marginalized and living in conditions of deprivation; and b) improving the socio-economic conditions in to which the most high-risk infants are born should not be considered unmodifiable in post-industrial well-resourced economies. We would also add that a consequence of reducing health inequalities within wealthy nations is that cultural behaviors associated with poverty become less important, and are subsequently more amenable to change.

Cross-cultural and sub-cultural variation in infant sleep location

Beyond Western post-industrial settings with medicalized infant-care, mother-infant sleep contact remains the cultural norm, and babies sleep in contact with a care-giver night and day (e.g. Morelli et al. 1992; Huang and Cheng 2006; Anuntaseree et al. 2008; Tan et al. 2009). Although solitary infant sleep (crib and/or separate room) is a current Western parental priority (Ball and Russell 2012) bed-sharing is common among certain sub-groups – particularly breastfeeding mother-infant dyads (Ball 2003; McCoy et al. 2004; Lahr et al. 2007; Blair et al. 2010), recent immigrant populations from non-Euro-American countries (Gantley et al. 1993; Farooqi et al. 1993; Rice and Naksook 1998), and culturally distinct minority groups (Tuohy et al. 1998; Eades et al. 1999; Abel et al. 2001; Patterson et al. 2002). Few of these sub-groups are recognized, or the validity of their cultural and behavioral differences addressed, in public health infant sleep recommendations.

Bed-sharing behavior has been surveyed in many Western countries, revealing a population prevalence of 40-50% of infants ever bed-sharing with at least one parent by age six months (Tuohy et al. 1998; Rigda et al. 2000; Brenner et al. 2003; Willinger et al. 2003; Blair and Ball 2004; Bolling 2007). Recent studies have documented bed-sharing prevalence in non-Western settings: of 682 clinic-attending mothers in Klang district, Malaysia, 74% reported bed-sharing (Tan et al. 2009). In Brazil, a large cohort study of 4231 infants found 48% of mothers and 3-month old infants bed-shared habitually (Santos et al. 2009). Anuntaseree et al. (2008) found 68% of 3722 3-month old infants in Thailand shared a bed with their parents. Bed-sharing is therefore part of mainstream infant-care around the world, but

there is variation among ethnic groups in factors that modify SIDS-risk in combination with bed-sharing.

Bed-sharing is a well-known feature of infant-care culture among New Zealand's Maori and Pacific Islander communities, but only among the Maori is bed-sharing linked with an increased SIDS-risk from smoking (Tuohy et al. 1988) as Pacific Islanders bed-share but rarely smoke (Mitchell et al. 1997). In contrast, although the SIDS rate in the 1990s of US Black infants were double those of white infants, the Chicago Infant Mortality Study found no interaction between bed-sharing and maternal smoking during pregnancy or postpartum; only bed-sharing with individuals other than parents was identified as a SIDS-risk (Hauck et al. 2003), however data on drug-use at the time of the infant's death are not reported in publications from this study, thereby limiting interpretation of the bed-sharing data; a published conference abstract provides data indicating prenatal drug use by mothers of SIDS infants in this study was particularly high, but does not relate this to bed-sharing deaths (Hauck and Smolkin, 2009). Among aboriginal Australians in Perth 68% of mothers bed-shared with their infants and 65% smoked during pregnancy (Eades et al. 1999). In contrast in the UK, South Asian infants are more likely to bed-share, but mothers rarely smoke (Ball et al. 2011, 2012, and below), as is the case for Thai infants in Australia (Rice and Naksook 1998). In each situation, therefore, bed-sharing carries different risks due to associations with other variables.

The strong association between bed-sharing and breastfeeding that was reported a decade ago (Ball et al. 1999; Ball 2002, 2003; Blair and Ball 2004) has been confirmed by numerous

researchers. Women who breastfeed are more likely to bed-share and bed-sharing is associated with greater breastfeeding duration (McCoy et al. 2004; Lahr et al. 2007; Anuntaseree et al. 2008; Tan et al. 2009; Blair et al. 2010). A large Brazilian study (Santos et al. 2009) found a 59% vs. 44% breastfeeding prevalence at 12 months for infants who bed-shared at 3-months and those who did not. The authors claim this is evidence of bed-sharing protecting against early weaning, however an association is not evidence of causality. The relationship may simply be that mothers who are inclined to breastfeed longer may also be more inclined to bed-share—i.e. a breastfeeding sub-culture whose understanding of infant sleep location differs from the majority population (Elias et al. 1986). It is not currently possible to clarify the direction of the bed-sharing-breastfeeding relationship; however mothers who breastfeed are more inclined to keep their babies in close proximity than those who never breastfeed (Pires 2011), supporting the sub-culture explanation.

Identifying sleep-related risks and risk-takers

As understanding of parent-infant sleep contact progresses (e.g. Ball 2006; Baddock et al. 2007; Volpe et al. this issue) questions emerge requiring further research. Is there an intrinsic difference in risk between bed-sharing dyads who breastfeed and those who don't? What is the risk for non-smoking breastfeeding bed-sharers versus smokers? Although no studies have calculated odds ratios for SIDS-risk among breastfed infants who bed-share, breastfeeding generally reduces the risk of SIDS (Vennemann et al. 2009; Hauck et al. 2011). Blanket recommendations regarding the avoidance of bed-sharing are therefore inappropriate even within relatively homogenous populations, as bed-sharing does not occur for the same motivations, nor carry the same risk for all families. Blanket

recommendations also have unanticipated consequences such as reduced breastfeeding, or adoption of more risky behaviors such as sleep-sharing on sofas. Kendall-Tackett et al. (2010) reported that 44% of mothers who fed their babies at night on chairs, recliners or sofas fell asleep while doing so, and these were more likely to be high-income, highly educated, otherwise 'low risk' mothers.

Identifying risks and at-risk subgroups

Blabey and Gessner (2009) examined a 13-year data-set on Alaskan infant deaths while bed-sharing to assess the contributions of other risk-factors. In 99% of cases at least one known risk-factor was present including maternal tobacco use (75%) and sleeping with an impaired person (43%). In contrast, frequent bed-sharing was reported for 38% of Alaskan infants, with most bed-sharers reporting no risk-factors. The authors conclude "infant bed-sharing in the absence of other risk factors is not inherently dangerous and thus [we] do not support a recommendation against all infant bed-sharing" (p.532). Likewise a UK study on hazardous sleeping environments identified a significant interaction between sleep-sharing deaths and recent parental use of alcohol or drugs; also a greater proportion of SIDS infants died while sofa-sharing than bed-sharing (Blair et al. 2009). The results of these studies clarify situations where sleep location is particularly risky, and where it is not, thereby identifying those parental behaviors which could be ameliorated or circumvented by targeted interventions.

Researchers are now using statistical modeling to identify subgroups that are potentially at-risk within heterogeneous populations. Blair et al. (2010) used latent class analysis to

identify behavioral clusters in UK longitudinal data on infant sleep location: non-sharers (66%), early bed-sharers (only in infancy, 13%), late bed-sharers (commencing after the 1st year, 15%), and constant bed-sharers (over a four-year period, 6%). Non-white ethnicity was significantly associated with all groups of bed-sharers, and particularly with constant bed-sharing. Early bed-sharing was associated with greater maternal education and fewer indicators of deprivation; late bed-sharing was associated with less maternal education and higher deprivation. The prevalence of breastfeeding was significantly higher among the groups that bed-shared constantly or early, than among the late or non-sharers. Although 11% of infants were still breastfed at 12 months, this differed by latent classes: 9% of non-sharers, 14% of late bed-sharers, 19% of early bed-sharers, and 34% of constant bed-sharers were breastfeeding at 12 months. The relationship with breastfeeding remained significant after controlling for confounders.

The authors concluded that the characteristics of UK families most likely to bed-share in the months following birth meant they had very low SIDS-risk, any benefit from preventing bed-sharing in this group would be very small, and by doing so breastfeeding may suffer. They recommend SIDS-reduction be targeted specifically at unsafe sleep-sharing; hence Safeguarding would avoid undermining Wellbeing for infants at low risk of unexpected death. The ability to more accurately anticipate which families may engage in high-risk activities will enable work with relevant communities on ways of ameliorating these.

Infant-care variation within a community: the Bradford Infant Care Study

There is a well-known discrepancy in UK SIDS rates between infants of South Asian and White British origin (the latter being four times greater than the former). Ball et al. (2011, 2012) investigated the relationship between infant-care practices, parental behaviors and ethnicity in the Bradford Infant Care Study (BradICS). This survey of 2560 families examined night-time care for 968 White British and 1212 Pakistani infants and found several key differences: Pakistani infants were breastfed and experienced supine sleep in the parental room; mothers avoided smoking, alcohol consumption, and sofa-sharing, but not pillows and duvets. White British infants experienced supine sleep with feet-to-foot of cot and a pacifier; mothers avoided bed-sharing, pillows and duvets, but not smoking, alcohol, sofa-sharing, separate rooms and use of formula. As Pakistani infant-care protects infants from the most substantial SIDS-risks this may explain their lower SIDS-rate. Culturally targeted health promotion campaigns to celebrate and reinforce these behaviors would raise awareness and help avoid transmission of majority-culture infant-care ideals that increase SIDS-risk.

The authors specifically examined bed and sofa-sharing in these two groups: Pakistani infants were significantly more likely to ever and regularly bed-share, ever breastfeed, and breastfeed for over 8 weeks, but less likely to ever sofa-share than White British infants. In both groups breastfeeding dyads were more likely to bed-share, particularly White British mothers who breastfed for eight or more weeks (Ball et al. 2012). Families who bed-shared in this UK study were very different from US bed-sharers: UK infants of teenage mothers, single mothers, and fathers who consumed alcohol were the *least likely* to bed-share, while

infants of a highly educated mothers, first-time mothers, breastfeeding, and/or Pakistani-origin mothers were more likely to bed-share. In contrast US bed-sharers are characterized as young, unmarried, poorly educated mothers from minority ethnic groups living in deprived circumstances, as well as mothers who breastfeed (McCoy et al. 1994; Willinger et al. 1998; Lahr et al. 2007). It should not be assumed that families who bed-share are similar across different geographic locations or minority ethnic groups. This leads us to challenge the notion that assumptions and guidance about infant-care can be exported from one setting (such as US) to another (such as UK), or indeed from one ethnic or cultural group to another even within a geographic setting. Evidence regarding the behaviors and beliefs of local populations and sub-groups are crucial in ascertaining which infants are at greatest risk when bed-sharing.

Confronting and modifying cultural traditions:

Although the US 'Back to Sleep' campaign was a nationwide success, the campaign did not penetrate all sectors of the population. Despite employing the KAB (knowledge, action, and behavior) change model (Backer 1992), African-American parents were resistant to SIDS-reduction information (Hackett 2007). Informing African-Americans of their infant's increased SIDS-risk did not empower mothers to reduce risks (many being beyond their control), but challenged their cultural beliefs, lived experiences and family wisdom regarding infant-care, and made them feel stigmatized. The problem, Hackett argues, was not in message transmission, but that the message itself was unacceptable to its recipients. This phenomenon can be observed in current US campaigns responding to Weese-Mayer's (1998) call for 'programs of instruction' on the hazards of bed-sharing. Billboards featuring

images of African-American women sleeping with their infants in a bed and a crib are labeled 'Wrong' and 'Right', together with large red crosses and green check marks. Magazine adverts depict beds with tombstone headboards bearing the inscription 'For too many babies last year this was their final resting place'. US public health campaigns now utilize the cultural traditions of Native Americans in SIDS-risk interventions—such as reviving the use of cradle-boards to promote supine infant sleep (NICHD 2010)—however such approaches have not yet penetrated the US bed-sharing discourse.

Blunt attempts to modify parenting behaviors embedded within cultural beliefs and ethnic identities are insensitive, can be insulting, and their ineffectiveness has been highlighted by others (Tipene-Leach et al. 2000; Lahr et al. 2007). In New Zealand, targeted interventions addressing bed-sharing related SIDS have been approached very differently; the Wahakura program illustrates how the development of interventions embedded within local cultural traditions can empower mothers to change their behavior without compromising their beliefs.

The Maori Wahakura

Maori babies have an increased SIDS-risk due to a combination of smoking during pregnancy and bed-sharing. The Wahakura intervention, initiated by Maori weavers and midwives, developed an infant sleep-basket using traditional weaving methods as an alternative to direct bed-sharing (Tipene-Leach 2007a; Tipene-Leach and Abel 2010). Because of the cultural preference for bed-sharing, the intervention aimed to make the parental bed a safe sleep environment for all Maori infants (rather than to discourage bed-sharing). The

Wahakura is a woven flax basket placed on the parents' bed for bed-sharing providing a convenient, flexible and portable sleep-space for the baby, based on a traditional Maori design, utilizing inexpensive/free materials (Tipene-Leach 2007b). An especially innovative element has involved engagement of Maori women in weaving Wahakura during their pregnancy. This increases commitment to using the Wahakura (having constructed it oneself), and encourages skill-transmission from mother-to-mother, reviving a tradition of basket-weaving for a new purpose. The Wahakura also provides a focus for written and verbal transmission of safe sleep education. Such innovative programs illustrate how creative interventions can help parents who value bed-sharing do so more safely even when other risks are present.

Conclusions

Clinical and academic discussion of infant sleep location has had a volatile history due to the personal and cultural value (or lack of value) attributed to bed-sharing. Public health / infant safety campaigns have approached bed-sharing as a modifiable infant-care practice that can be influenced by risk-education and simple recommendations. The observation that parents persist in bed-sharing with their infants despite knowledge of potential risks is frustrating to those attempting to reduce bed-sharing deaths. Escalation of the intensity of information campaigns is borne of this frustration—but is unlikely to eliminate bed-sharing. For many groups of parents, bed-sharing forms part of their cultural or personal identities, so the message to desist is unacceptable and rejected.

Our first point, then, is that failure to recognize the role of bed-sharing in ethnic and sub-cultural identity within the US has led to inappropriate and ineffective interventions that are ignored by their target populations. Elsewhere detailed research into who bed-shares, how, and why is helping to define who is at risk, and how to promote safer bed-sharing to these groups. As with the Wahakura, culturally embedded interventions can focus awareness on infant sleep environments and engage communities in discussion about how bed-sharing can be conducted more safely, without alienating the target community by attacking a culturally-valued behavior.

Our second point is to urge caution in adopting risk reduction guidelines across populations with different risk-factor profiles; it is inappropriate to transfer health-related recommendations from one cultural setting to another without evaluating variation between the target and source populations. Over the past 20 years the majority of infant sleep safety research capturing dangerous sleep practices in minority populations was US-generated, and led to stringent bed-sharing recommendations (AAP 2005). The broader picture of bed-sharing around the world does not reflect the picture garnered in the US. Specific research is needed in different countries to understand the importance of bed-sharing (and other parental behaviors) to those for whom it forms part of ethnic or parenting identity, and to address those combinations of circumstances that make certain behaviors hazardous for infants in supportive (rather than instructive) ways that are cognizant of the local landscape of infant-care.

For many years our understanding of, and approach to, infant-care issues such as bed-sharing have been somewhat crude and risk reduction campaigns have been rather blunt instruments aimed at modifying infant-care practices simply via provision of information. By generating increasingly detailed research evidence about bed-sharing, more sophisticated and focused infant sleep-safety measures can now be devised and implemented providing the opportunity for discourse around infant sleep location to move away from 'do' and 'don't' and towards 'who', 'how', and why?

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